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ANALYSIS OF MATHEMATICAL CRITICAL THINKING SKILLS USING DIFFERENTIATION LEARNING ON JUNIOR HIGH SCHOOL STUDENTS BASED ON LEARNING STYLE

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ABSTRACT

Critical thinking skills are one of the level thinking skills, critical thinking is also no less important for students to master. In fact, students experience difficulties in developing mathematical critical thinking skills, this can be seen from students' learning outcomes which are not yet optimal. From this statement, researchers conducted research on students' mathematical critical thinking abilities. This research aims to analyze students' mathematical critical thinking abilities by using differentiation learning for junior high school students on algebra material. Differentiated learning is a learning strategy recommended by the government to support the implementation of an independent curriculum. The subjects of this research were 30 seventh grade students in junior high school in Purwakarta. This research uses a descriptive method with a qualitative approach. The stages in this research are planning, implementation and reporting. The test is given 5 questions according to indicators of critical thinking abilities. Before taking the test, students are first asked questions about their learning style. The results of the mathematical critical thinking ability test with differentiated learning show that 63% of students with a visual learning style are able to check the truth of an argument, 39% of students with a kinesthetic learning style can formulate questions with reasons, 37% of students with a visual learning style are able to identify relevant data, 38% of students with a visual learning identifies assumptions, 35% of kinesthetic learning styles are able to solve problems. Students' mathematical critical thinking abilities vary according to students' learning styles and other learning needs. It can be concluded that mathematical critical thinking abilities are influenced by differentiated learning.

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INTRODUCTION

Mathematical critical thinking skills is an important basic mathematical skills that students who study mathematics need to have (Hendriana, Rohaeti, Sumarmo, 2017: 95). In learning mathematics at school, most students only pay attention and the teacher plays an active role. In learning, students are rarely trained with questions that are not routine so that students are not used to it (Yunita et al., 2018). Critical thinking skills are the abilities a person needs to be able to face various problems faced in social and personal life (Nuryanti et al., 2018). The importance of having critical thinking skills is that it provides additional direction to students when thinking and solving mathematical problems. As one of the higher level thinking skills, critical thinking is no less important for students to master. It is not only used in dealing with problems in mathematics learning, but is implemented in concrete problems in everyday life.

The results of the 2018 Program for International Student Assessment (PISA) study (OECD, 2018) placed Indonesia in the lowest 7th place among 72 other countries in the mathematics category. Based on the research results, it can be concluded that students' high-level thinking abilities in Indonesia are still relatively low. One of the higher order thinking skills is the ability to think critically. The low level of critical thinking skills is caused by several factors, namely students tend to memorize material and formulas rather than understanding concepts. This is in accordance with initial research by Sianturi et al (2018). Students have difficulty developing their critical thinking skills so that the learning outcomes obtained by students are not optimal based on the 2019 National Examination Report of Junior High School (Puspendik, 2019), 46.56 (Maesaroh, S et al., 2021). Apart from that, the result shows that students' critical thinking in mathematics is not good enough and they need to get used to working on critical thinking questions (Nurdwiandari, 2018). Students sometimes feel lazy to solve problems because they lack the knowledge to solve them (Putra, 2018)

Heterogeneity of students in class is a natural thing, they have different emotional, intelligen, social, academic abilities, parenting styles and many more. Based on the idea of student heterogeneity, researchers have used different learning strategies to improve students' critical thinking skills and enjoyment of learning. The use of differentiation learning strategies is considered appropriate to overcome the problem of student heterogeneity. Attention to differentiated learning focuses on students paying attention to their strengths and learning needs. Differentiated learning does not increase students' learning burden, but rather creates a pleasant learning atmosphere, stimulating them to continue learning so as to help the success of their studies (Herwina, 2021). Differentiated learning pays attention to student learning readiness, student interests and student learning profiles, including student learning styles.

Differentiated learning is a learning strategy recommended by the government in implementing an independent curriculum. According to Marlina (2019) differentiated learning is an adjustment to students' interests, learning preferences and readiness to achieve improved learning outcomes. Differentiated learning is learning that accommodates the needs of each individual to gain learning experience and mastery of the material studied (Nurdini, 2021; Kamal, 2021; Lupita & Hidayat, 2022). There are three important aspects of student learning needs in differentiated learning (Tomlinson, 2001), including student learning readiness, student learning interest, and student learning profile. The application of differentiated learning in mathematics subjects can improve student learning outcomes through classifying student abilities, using material development that varies according to student abilities, and taking an individual approach (Syarifuddin; 2022). The differentiation learning process can provide ample space for students to demonstrate what they have learned so that differentiation learning indirectly encourages student creativity (Herwina; 2021). The research results of Candra Ditasona (2013) show that the improvement in mathematical problem solving abilities of students who take differentiated learning is better than students who take conventional

learning. Evi Lailiyah (2016) obtained the results of her research that improving students' critical thinking skills with differentiated learning was better than students who received regular learning.

Differentiated learning is a teaching strategy that aims to adapt teaching and learning activities according to the needs, interests and abilities of each student. This can be an effective solution for improving students' critical mathematical thinking skills. By implementing differentiated learning, teachers can create a more inclusive and effective learning environment, where each student can develop according to their abilities and hone their mathematical critical thinking skills optimally. The aim of this research is to analyze students' mathematical critical thinking abilities by implementing differentiation learning.

METHOD

The research method used is descriptive qualitative which aims to analyze the implementation of differentiation learning carried out by mathematics teachers regarding linear equations with one variable in grade VII Junior High School in Purwakarta in semester 2 of the 2023/2024 academic year. This research involved 30 seventh grade students from one of the junior high schools in Purwakarta. Not only that, every student completes a non-diagnostic assessment to determine his or her learning needs. After that, observations were made during educational activities, then students' mathematical critical thinking abilities were analyzed. This research places greater emphasis on descriptive presentation which is intended to describe differentiated learning in accordance with the implementation of the independent learning curriculum.

The instrument in this research is a set of mathematical critical thinking skills tests consisting of 5 questions with indicators of mathematical critical thinking skills according to Enis (2013);

Table 1. Indicators of Mathematical Critical Thinking Skills

No	Indicators
1	Basic Clarification
2	Basic Support
3	Conclusion
4	Deep clarification
5	Strategy and Tactics

The non-diagnostic assessment instrument used is a questionnaire to group students according to their learning needs which consist of student learning styles. They are visual, auditory and kinesthetic.

RESULTS AND DISCUSSION

Results

Based on the research, non-diagnostic assessment data was obtained in the form of learning styles of class VII students. The results of the worksheets are used to collect information about students' critical mathematical thinking skills which are described in the table 2.

Table 2. Percentage of students who have mathematical critical thinking skills based on learning style

No	Indicators	Learning Style		
		Audio	**Visual**	**Kinesthetic**
1	Basic Clarification	23%	60%	27%
2	Basic Support	28%	33%	39%
3	Conclusion	30%	37%	33%
4	Deep Clarification	27%	38%	35%
5	Strategy and Tactics	34%	31%	35%

The calculation results in table 2 were obtained from

$$\frac{P}{N} \text{x}100\%$$

p = number of students who answered correctly

n = total number of students

Every student who has a different learning style has different mathematical critical thinking abilities.

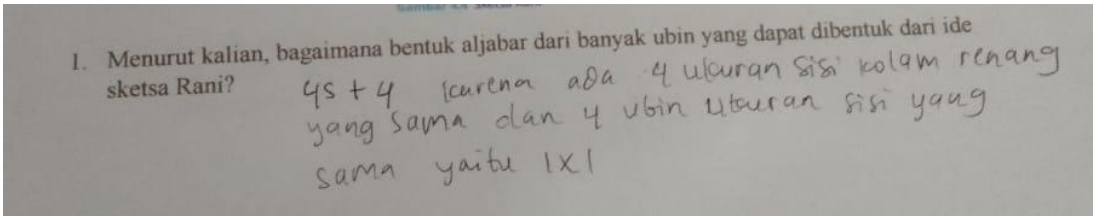

Figure 1. Student Answer Results Indicator Number 1

Auditory learning style students show 23%, students with a visual learning style students show 60% can check the truth of arguments and students with a kinesthetic learning style show 27% can check the truth of arguments. From the answers of students who are more able to answer correctly on the indicator of checking the truth of the argument, they are students who have a visual learning style.

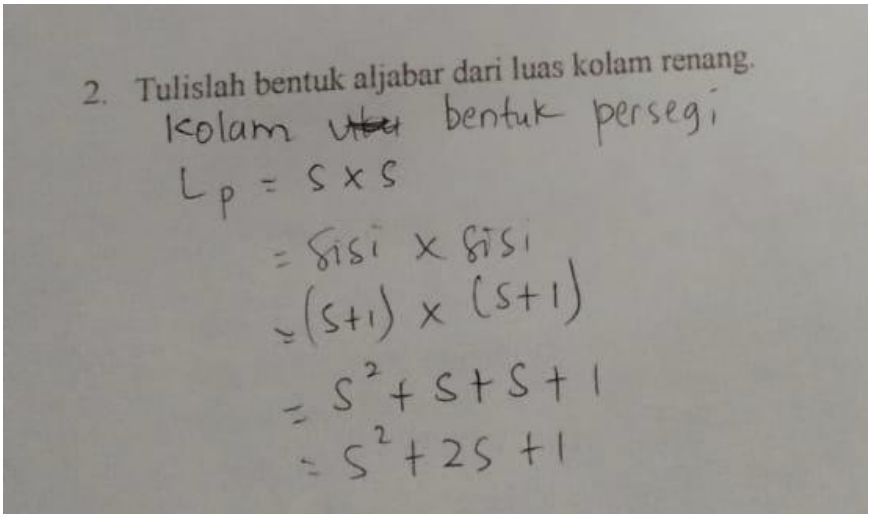

Figure 2. Student Answer Results Indicator Number 2

Students with an auditory learning style are capable of 28% answer questions with reasons, 33% of students with a visual learning style can answer with reasons and 39% of students with a kinesthetic learning style can answer questions with reasons. From the answers of students who are more able to answer correctly on the indicator of formulating questions, the reason is that students have a kinesthetic learning style.

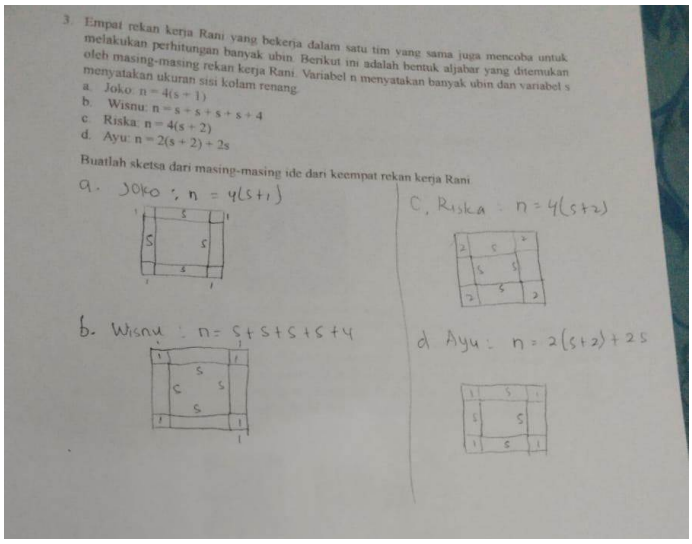

Figure 3. Student Answer Results Indicator Number 3

Students with an auditory style get 30% identify relevant data, 37% of visual learning styles can identify relevant data and 33% of students with kinesthetic learning styles can identify relevant data. From the answers of students who are more able to answer correctly in identifying relevant data the reason is that students have a visual learning style.

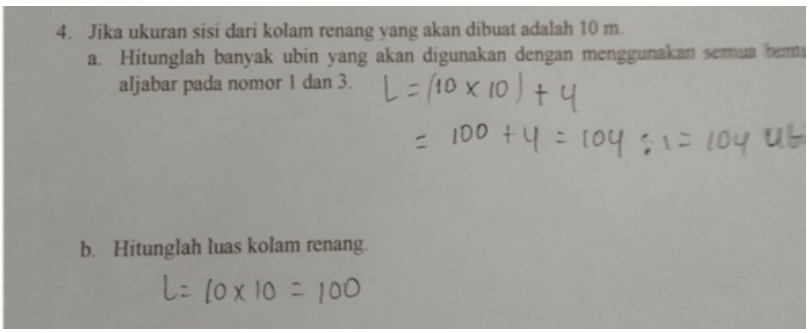

Figure 4. Student Answer Results Indicator Number 4

Students with an auditory learning style are capable of 27% identify assumptions, 38% of visual learning styles identify assumptions and 35% of students with kinesthetic learning styles can identify assumptions. From the answers of students who are more able to answer correctly on the indicators of identifying assumptions, the reason is that students have a visual learning style.

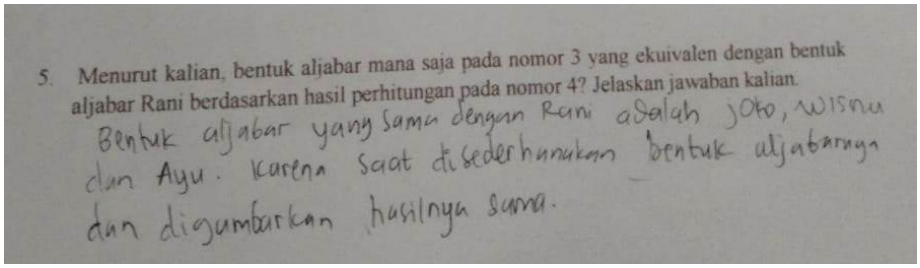

Figure 5. Student Answer Results Indicator Number 5

Students with an auditory learning style can reach 34% solve the problem, 31% of visual learning styles can solve problems and 35% of students with kinesthetic learning styles can solve problems. From the students' answers, more students were able to answer correctly on the indicators of solving problems on the grounds that students have a kinesthetic learning style.

Discussions

Based on the research results, it shows that the student learning needs are suitable to student learning styles. If learning needs are fulfilled, there will be various students' mathematical critical thinking skills:

a. Basic Clarification

One of the results of students' work on the basic clarification indicator is Figure 1. The results of the analysis of students who have a visual learning style are more able to answer correctly in accordance with the results of Firdaus and Rustina's research showing that students who learn visually and students who learn kinesthetically show strong critical thinking abilities. enough, while students who learn auditorily show good critical thinking skills (Firdaus & Rustina, 2019).

b. Basic Support

Figure 2 shows one of the results of students' work in basic support along with reasons. Students whose learning style is kinesthetic are better able to work on these questions than students with auditory and visual learning styles, according to the research results. (Setiana & Purwoko, 2020) that sStudents who learn kinesthetically have good critical thinking skills.

c. Conclusion

Figure 3 shows that the results of the work of students who are able to make conclusion are outperformed by students whose learning style is visual. This is in accordance with Setiana and Purwoko's research which shows that students who learn visually have superior critical thinking skills, while students who learn auditorily show sufficient critical thinking skills. Students who learn kinesthetically have good critical thinking skills (Setiana & Purwoko, 2020)

d. Deep clarification

Figure 4 shows the results of the work of students who are able to deep clarification by students whose learning style is visual.This is in accordance with Setiana's research and Purwoko who shows that students who learn visually have superior critical thinking skills, while students who learn auditorily show sufficient critical thinking skills. Students who learn kinesthetically have good critical thinking skills (Setiana & Purwoko, 2020)

e. Strategy and Tactics

Figure 5 shows that the results of the work of students who were able to make strategy and tactics were outperformed by students whose learning style was kinesthetic. This is in accordance with research Setiana and Purwoko showed that students who learn visually have superior critical thinking skills, while students who learn auditorily show sufficient critical thinking skills. Students who learn kinesthetically have good critical thinking skills (Setiana & Purwoko, 2020)

All indicators of mathematical critical thinking abilities that were tested on students whose learning styles were audio, visual and kinesthetic had different results. The results of this research are in accordance with the research results of Wilujeng & Sudihartinih, 2021), that students' mathematical critical thinking abilities vary according to the students' preferred learning styles. (Different learning styles so that the content given to students varies according to students' learning needs. When the learning process is different, the products produced are also different. That is differentiated learning recommended by the government in implementing the independent learning curriculum.

Differentiated learning aims to develop students' potential, with differentiated learning so that students' learning needs are met, the learning that students feel is meaningful and beneficial for students. The researcher's findings are that differentiation learning in mathematics learning can develop students' mathematical critical thinking skills in accordance with students' learning needs.

CONCLUSIONS

This research shows that students' mathematical critical thinking abilities vary according to the results of non-diagnostic assessments in the form of learning styles. There is a percentage of answers that have been answered by students who have different learning styles regarding indicators of critical thinking abilities that have been answered by students, but the difference in student answer results is not very significant, there is only a slight difference. This requires further research to find out whether students' learning styles influence mathematical critical thinking abilities

Different from students' learning styles, the content given to students during learning is also different so that the processes experienced by students during learning are also different. From the different processes, it can be seen that students' mathematical critical thinking abilities are different. Differentiated learning is recommended in implementing an independent learning curriculum to develop student potential.

It is recommended for future researchers to conduct further research before students are given differentiated learning so that students' critical thinking abilities can be seen and they are given other learning approaches in collaboration with interactive media.

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